Annals of the Faculty of Computer and Information Sciences, Hosei University

No.5 March 2005

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Contents

Department of computer science

Department of digital media

Professor

Runhe HUANG

Refereed Publications

1. Runhe Huang, T Yamazaki and Jianhua Ma, "A Mobile Negotiation Agent Embedded Hybrid Online Purchasing System", IEEE CS Press Proc. of the International Workshop on Multimedia Network Systems and Applications (MNSA'2004), in conjunction with the 24th IEEE International Conference on Distributed Computing Systems (ICDCS-2004), pp222-227, Tokyo, Japan, March, 2004.

   Abstract — This paper presents a mobile negotiation agent under the proposed hybrid architecture and shows how a buyer negotiation agent conducts online purchasing activities automatically. This paper gives the detailed about our design ideas, the system architecture and implementations. Comparisons with other related work are reported in the paper.

2. Hiroko Suzuki and Runhe Huang, "Virtual Real-time 3D Object Sharing for Supporting Distance Education and Training", IEEE CS Press Proc. of the 18th IEEE International Conference on Advanced Information Network and Applications (AINA'04), pp445-450, Fukuoka, March 2004.

   Abstract — This paper presents a virtual real-time 3D object sharing system. Its potential applications include team housing, car, and computer art designs and in particular, for supporting distance education and training of younger/junior designers. This paper will describe its functionality and implementations with underlying considerations in order to achieve real-time sharing: avoiding bottleneck network problem by transferring events instead of whole 3D object data; avoiding operation collision on shared objects by applying designate floor control policies; and simplifying client program and avoiding unnecessary data communications by applying remote method invocation technology. The roles of virtual real-time 3D object sharing in distance education and training of designers are stressed and demonstrated in this paper.

3. Jianhua Ma, Leonard Barolli, Makoto Shizuka and Runhe Huang, "A Pure P2P Synchronous Collaborative System", in the International Journal of Applied System Studies (JASS), Cambridge International Science Publishing, Cambridge, England, No.2, Vol.5, July 2004, pp. 133-145.

   Abstract — This paper presents design and implementation of a collaborative system, called DSC, based on a pure P2P architecture, i.e., a decentralized topology, without using any server at all. It relies on group agents located on peers' computers to coordinate group

as well as peer management, and provides a message handler to deal with the correct message passing directly among group peers. DSC is implemented using JXTA technology that includes virtual JXTA networks, a set of standard protocols and basic services to let peers finding each other, forming groups, and exchanging messages across firewalls and NATs. Our system currently offers four shared objects, a web html file browser, a plain text file viewer, an audio player and a drawing pad as well as a text chat tool.

4. Jianhua Ma, Ryosuke Komatsu and Runhe Huang, "A Web-based Teacher Assisting Agent System", Springer-Verlag Lecture Notes in Computer Science, Advances in Web-Based Learning ? ICWL'2004, Volume 3143, ISBN 3-540-22542-0, 2004, pp. 317-324.

Abstract — In the conventional teaching, teaching assistances (TAs) play importance roles in supporting a teacher's teaching activities. This paper presents a Web-based teacher assisting agent system in which a set of automated programs, so called agents in this context, is developed. It is described that how the agents are generated, where they reside, and how they work independently or collaborate with each other to assist a teacher. It is emphasized that a later developed working agent can be easily incorporated into the system under the developed system framework. It is addressed that both agent persistency and mobility in the system can be achieved by the proposed mechanisms.

5. Runhe Huang, Takeshi Yamazaki, and Jianhua Ma, "A Mobile Intelligent Negotiation Agent Embedded and Hybrid Architecture Based Online Purchasing System", in the International Journal of Wireless and Mobile Computing, Inderscience Publishers, ISSN 1741-1084, No. 4, December, 2004.

Abstract — This paper proposes a *m*obile intelligent *ne*gotiation *agen*t embedded and *h*ybrid architecture based *o*nline *p*urchasing *s*ystem (*MineAgeHops* in short) with three emphases: agent mobility, intelligent negotiation, and hybrid architecture. Like in the physical world, a buyer agent can travel over the Internet to a remote e-shop for obtaining information about a product and negotiating on the product with a seller. Human negotiation is a complex process. The evolutionary negotiation model makes an effort to reflect different negotiation levels of human with increasing knowledge and experience as time goes. A hybrid of centralized and decentralized architecture can overcome the network bottleneck problem as well as improve purchasing efficiency by enabling agent mobility and flexibility.

6. Tomoya Enokido, Runhe Huang, and Makoto Takizawa, "Concurrency Control for Distributed Objects using Role Ordering (RO) Scheduler", Proc. of the IPSJ Symposium Series, Vol. 2004, No. 15, ISSN 1344-0640, pp101-106, Ishikawa, Japan, December, 2004.

Abstract — A concept of role is significant to design and implement a secure information system. A role shows a job function in an enterprise. In addition to keeping system secure,

objects have to be consistent in presence of multiple transactions. Traditional locking protocols and timestamp ordering schedulers are based on principles "first-comer-winner" and "timestamp order" to make multiple conflicting transactions serializable, respectively. We define a significantly precedent relation on roles showing which one of a pair of roles is more significant than another one in an enterprise. We discuss a scheduler so that multiple conflicting transactions are serializable in a significant order of roles of transactions.

Professor

Satoru S. KANO

Books

1. Munetake Ichimura and Satoru S. Kano, "Introduction to Physics, I. Mechanics (物理学入門 I、力学)", Tokyo Kagaku Dojin (東京化学同人), ISBN 4-8079-0578-3, 2004.

   Abstract — This is a text book of introductory physics for undergraduate students in the fields of natural science and engineering, without assuming a prior education in physics at high school. We focus on a coherent introduction to mechanics around a very few basic principles and reasoning methods by the use of basic calculus. Qualitative as well as quantitative descriptions and reasoning methods are emphasized. We use this book as a course material at Computer and Information Sciences, Hosei University.

Refereed Publications

1. T. Okada, I. Otake, R. Mizoguchi, K. Onda, S. S. Kano and A. Wada, "Optical control of two-photon excitation efficiency of α-perylene crystal by pulse shaping", Journal of Chemical Physics, American Institute of Physics, No.13, Vol. 121, 2004, pp.6386-6391.

   Abstract — Optimized pulse shaping experiments were carried out on the control of two-photon excitation efficiency of an a-perylene crystal in the temperature region from 30 to 290 K. It was found that a pulse train with a pulse interval of 90 fs and an alternately reversing phase relation increased the excitation efficiency by a factor of 2 for the whole temperature region. The pulse shape characteristic for effective efficiency increase was educed by double pulse experiments in which the dependence of the emission intensity on the pulse interval and relative phase between pulses were measured. The mechanism of the efficiency increase is briefly discussed using a sliding-window Fourier transform of the pulse shape.

Professor

Nobuhiko KOIKE

Refereed Publication

1. Nobuhiko Koike, Norihiro Fujii: "Parallel and Distributed Processing Laboratory for CS 2nd Grade Students: An Active N to N networking Approach", Proc. 5th International Conference on Information Technology Based Higher Education and Training (ITHET), June 2004, Istanbul, Turkey.

   Abstract — This work describes authors' approach at the authors' university during last three years for the computer science second grade undergraduate students to experience parallel and distributed computing. The goal is set to give a solid understanding of parallel and distributed processing technologies and to build up basic skills in the field, such as Parallel algorithms, multi-thread/network programming, IP/socket communication, MVC paradigm, RPC/Remote Method Invocation (RMI), Database/SQL, and JAVA/JDBC. The course features a combination of active experimental Learning and N to N networking approach. Unlike typical laboratories where central parallel servers or parallel machines are used (N users to one system networking), our laboratories do without them and instead organize groups of student PCs to form virtual parallel/distributed systems (N users to N systems networking). All PCs work as Servers as well as Clients. Parallel Buckets Sorting and Virtual Shopping Mall implementations are employed for the course projects. The course consists of 14 ninety-minutes sessions within a semester, including introductory JAVA network programming and two projects. As the time is limited, the homework and pre-laboratory experiments are encouraged. The Web based course material distribution and the virtual laboratory environment contributed to bring most students to success.

2. N. Fujii, S. Yikita, N. Koike and T. Kunii: "An E-Learning System Based on the Top-Down Method and the Cellular Models", International Journal of Distance Education Technologies, Vol. 2, No. 4, Oct-Dec 2004, pp.77?pp.93

   Abstract — We propose new top-down eLearning tools for hardware logic design course using the Cellular Methods, where students can keep focusing on their primary interests to achieve complex logic circuits design successfully. At a modern logic design classroom, hardware description languages such as VerilogHDL are mostly used to describe circuits for FPGAs. The circuit in each module is described in VerilogHDL and the entire circuit is implemented by combination of designed modules. These HDL descriptions are wrapped in XML and enriched by a specially extended XML vocabulary, in order to share designed modules among learners on the Web. Although XML gives us a common and convenient Web framework, it becomes difficult to verify, validate, and maintain conformance among designed modules if the system becomes very large. To overcome this problem, we employed the Cellular Models that ensure the consistency among design modules and

support a top-down design methodology. The proposed top-down eLearning tools can generate these circuit design data, distribute them to the learner, and manage the design database. The circuit design data wrapped in XML vocabulary are offered to the learner as a self-learning material of the courseware using the top-down (i.e. goal-oriented) method, according to the demand and the purpose of the learner. This paper also presents the basic XML vocabulary design to describe hardware modules efficiently, and introduces the structure and the function of the proposed system which implements these eLearning tools.

Professor

Yamin LI

Refereed Publication

1. Yamin Li, Shietung Peng, and Wanming Chu, "Fault-Tolerant Cycle Embedding in Hypercube with Mixed Link and Node Failures", *Proceedings of the IASTED International Conference on Parallel and Distributed Computing and Networks*, February, 2004, Innsbruck, Austria. pp.561-566.

   Abstract — In this paper, we show that given a binary n-cube with $f_e \leq n-2$ and $f_e + f_v \leq 2n-4$, where f_e and f_v are the numbers of faulty links and faulty nodes, respectively, there exists a fault-free cycle of length at least $2^n - 2f_v$. This result is better than any previous results in the literature.

2. Yamin Li, Shietung Peng, and Wanming Chu, "Efficient Collective Communications in Dual-cube", The Journal of Supercomputing, Volume 4, issue 1, 2004, pp.71-90.

   Abstract — The hypercube, or n-cube, has been widely used as the interconnection network in parallel computers. However, the major drawback of the hypercube is the increase in the number of communication links for each node with the increase in the total number of nodes in the system. This paper introduces a new interconnection network, namely dual-cube, for large-scale parallel computers and describes the algorithms for efficient collective communications in dual-cube. The dual-cube network mitigates the problem of increasing number of links in the large-scale hypercube network while retains hypercube's topological properties. Design of efficient routing algorithms for collective communications is the key issue for any interconnection network. In this paper, we show that the collective communications can be done in dual-cube with almost the same communication times as in hypercube.

3. Yamin Li, Shietung Peng, and Wanming Chu, "Adaptive-Subcube Fault Tolerant Routing in Dual-Cube with Very Large Number of Faulty Nodes", *Proceedings of the ISCA 17th International Conference on Parallel and Distributed Computing Systems*, San Francisco, California USA, September, 2004, pp222-228.

   Abstract — The dual-cube is a newly proposed interconnection network for linking a large amount of nodes with low node degree. It uses low-dimensional hypercubes as building blocks and keeps the main desired properties of the hypercubes. In this paper, we give an efficient algorithm for fault tolerant routing in dual-cube networks with a large number of faulty nodes. Our algorithm uses the adaptive-subcube technique to select a suitable dimension to route a node. This technique not only increases the routing speed but also shortens the path and improves the successful routing rate. The

experimental results show that, with high percentages of node failures, the algorithm can build routing paths with a very high probability. Our simulation results show that when a dual-cube with 32,768 nodes contains up to 20 percent faulty nodes, the success rate of constructing a fault-free path between any two nonfaulty nodes is 99.5 percent with a 4-subcube.

4. Yamin Li, Shietung Peng, and Wanming Chu, "An Efficient Algorithm for Fault Tolerant Routing Based on Adaptive Binomial-Tree Technique in Hypercubes", *Proceedings of the Fifth International Conference on Parallel and Distributed Computing, Applications and Technologies*, December, 2004 Singapore. pp.196-201.

Abstract — We propose an efficient fault-tolerant routing algorithm for hypercube networks with a very large number of faulty nodes. The algorithm is distributed and local-information-based in the sense that each node in the network knows only its neighbors' status and no global information of the network is required by the algorithm. For any two given nonfaulty nodes in a hypercube network that may contain a large fraction of faulty nodes, the algorithm can find a fault-free path of nearly optimal length with very high probability. The algorithm uses the adaptive binomial-tree to select a suitable dimension to route a node. We perform empirical analysis of our algorithm through simulations under a uniform node failure distribution and a clustered node failure distribution. The experimental results show that the algorithm successfully finds a fault-free path of nearly optimal length with the probability larger than 90 percent in a hypercube network that may contain up to 50 percent faulty nodes.

5. Yamin Li, Shietung Peng, and Wanming Chu, "Binomial-Tree Fault Tolerant Routing in Dual-Cubes with Large Number of Faulty Nodes", *Proceedings of the International Symposium on Computational and Information Sciences.* Shanghai, China, December, 2004. pp.51-56.

Abstract — A dual-cube DC(m) has m+1 links per node where m is the degree of a cluster (m-cube), and one extra link is used for connection between clusters. The dual-cube mitigates the problem of increasing number of links in the large-scale hypercube network while keeps most of the topological properties of the hypercube network. In this paper, we propose efficient algorithms for finding a nonfaulty routing path between any two nonfaulty nodes in the dual-cube with a large number of faulty nodes. A node $v \in$ DC(m) is called k-safe if v has at least k nonfaulty neighbors. The DC(m) is called k-safe if every node in DC(m) is k-safe. The first algorithm presented in this paper is an off-line algorithm that uses global information of faulty status. It finds a nonfaulty path of length at most $d(s,t)+O(k^2)$ in $O(|F|+m)$ time for any two nonfaulty nodes s and t in the k-safe DC(m) with number of faulty nodes $|F| < 2^k(m+1-k)$, where $0 \leq k \leq m/2$. The second algorithm is an online algorithm that uses local information only. It can find a fault-free path with high probability in an arbitrarily faulty dual-cube with unbounded number of faulty nodes.

Professor

Shaoying LIU

Books

1. Shaoying Liu, "Formal Engineering for Industrial Software Development Using the SOFL Method", Springer-Verlag, ISBN 3-540-20602-7, 2004.

   Abstract — In any serious engineering discipline, it would be unthinkable to construct a large system without having a precise notion of what is to be built and without verifying how the system is expected to function. Software engineering is no different in this respect.

   Formal methods involve the use of mathematical notation and calculus in software development; such methods are difficult to apply to large-scale systems with practical constraints (e.g., limited developer skills, time and budget restrictions, changing requirements). Here Liu claims that formal engineering methods may bridge this gap. He advocates the incorporation of mathematical notation into the software engineering process, thus substantially improving the rigor, comprehensibility and effectiveness of the methods commonly used in industry.

   This book provides an introduction to the SOFL (Structured Object-Oriented Formal Language) method that was designed and industry-tested by the author. Written in a style suitable for lecture courses or for use by professionals, there are numerous exercises and a significant real-world case study, so the readers are provided with all the knowledge and examples needed to successfully apply the method in their own projects.

Refereed Publications

1. Shaoying Liu: "An Automated Rigorous Review Method for Verifying and Validating Formal Specifications", Second International Symposium on Automated Technology for Verification and Analysis, LNCS 3299, Taipei, Taiwan, Oct. 31- Nov. 3, 2004, pp. 15-19.

   Abstract — Ensuring the consistency of formal specifications is one of the most desirable goals to achieve in software development with formal methods. In this paper we describe an automated rigorous review method for verifying and validating formal specifications written in SOFL (Structured Object-oriented Formal Language). The essential idea of the method is to automatically derive all the critical properties of a specification first and then review the specification to ensure that it satisfies all the properties. We also present a prototype software tool that can guide a reviewer to apply the method to review a specific specification.

2. Fumiko Nagoya, Shaoying Liu, Yuting Chen: "An Investigation of the Approach to Specification-based Program Review through Case Studies", The

9th IEEE International Conference on Engineering of Complex Computer Systems (ICECCS2004), Florence, Italy, April 14-16, 2004, pp. 249-258.

Abstract — Software review is an effective means to enhance the quality of software systems. However, traditional review methods emphasize the importance of the way to organize reviews and rely on the quality of the reviewers' experience and personal skills. In this paper we propose a new approach to rigorously reviewing programs based on their formal specifications. The fundamental idea of the approach is to use a formal specification as a standard to check whether all the required functions and properties in the specification are correctly implemented by its program. To help investigate the effectiveness and the weakness of the approach, we conduct two case studies of reviewing two program systems that implement the same formal specification of "A Research Management Policy" using different strategies, and present the evaluation of the case studies. The results show that the review approach is effective in detecting faults when the reviewer is different from the programmer, but less effective when the reviewer is the same as the programmer.

3. Yuting Chen and Shaoying Liu: "An Approach to Detecting Domain Errors Using Formal Specification-Based Testing", The 11th Asia-Pacific Software Engineering Conference, Nov. 30 - Dec. 3, 2004, pp. 276-283, 2004.

Abstract — Domain testing, a technique for testing software or portions of software dominated by numerical processing, is intended to detect domain errors that usually arise from incorrect implementations of designed domains. This paper describes our on-going work aiming to provide support for revealing domain errors using formal specifications. In our approach, formal specifications serve as a means for domain modeling. We describe a strong domain testing strategy that guide testers to select a set of test points so that the potential domain errors can be effectively detected, and apply our approach in two case studies for test cases generation.

4. Yuting Chen, Shaoying Liu, Fumiko Nagoya: "An Approach to Integration Testing Based on Data Flow Specifications", First International Colloquium on Theoretical Aspects of Computing (ICTAC2004), 405-419, 2004.

Abstract — Integration testing of programs based on formal specifications can benefit considerably from the comprehensibility of the specifications. In this paper, we describe an approach to testing programs based on data-flow-oriented specifications by analyzing data flow paths and discussing criteria for test case generation. This approach suggests a specific way to generate test cases directly from formalized data flow diagrams and the associated textual specifications. We apply the approach in a case study of testing part of an ATM system to evaluate its effectiveness in fault detection and to uncover its weakness for further improvement.

5. Shaoying Liu: "A Framework for Developing Dependable Software Systems Using the SOFL Method", First Workshop on Dependable Software

(DSW2004), Tokyo, Feb. 23-24, 2004, pp. 131-140.

Abstract — Development of a dependable software system requires a variety of techniques to be used in a coherent and systematic process, since it needs to take both the reliability and safety and/or security of the system into account. In this paper, we describe a framework for developing dependable software systems using the SOFL formal engineering method, and demonstrate its applicability by a case study of developing an ATM system using the framework.

Other Publications

1. Shaoying Liu: "A Rigorous Method for Reviewing Formal Specifications", First Workshop on New Approaches to Software Construction, Tokyo, Sept. 13-14, 2004, pp. 153-167.

2. Shaoying Liu: "Formal Engineering for Industrial Software Development - An Introduction to the SOFL Specification Language and Method", A tutorial for 6th International Conference on Formal Engineering Methods (ICFEM2004), Settle, USA, Nov. 8-12, 2004.

3. S. Liu, F. Nagoya, Y. Taira, S. Shimizu, "Design and Implementation of a Supporting Tool for Specification Reviews and an Empirical Experiment", Technical Report, HCIS-2004-03.

4. S. Liu, "A Survey on the Use of SOFL Based on Four Projects", Technical Report, HCIS-2004-01.

Professor

Tetsuo MIZOGUCHI

Other Publications

1. Tetsuo Mizoguchi, 'Technical Document of ATN Performance Version 3',
   ICAO Asia/Pacific ATN Transition Task Force Meeting WP 7, Bali, 26-30, Apr.,2004
   Tasked by ICAO Asia/Pacific Planning Group supported by Japanese Civil Aviation Bureau (JCAB), Ministry of Infrastructure, Land and Transportation (MILT), Japanese Government

2. Tetsuo Mizoguchi, 'MTA Transitional Routing Policy',
   ICAO ATN Transition Task Force Meeting WP 10, Bali, 26-30, Apr., 2004
   Joint work by Japanese delegates headed by JCAB, MILT, Japanese Government

3. Tetsuo Mizoguchi, 'Routing Impact Study of Proposed AMHS Routing and ATN Link',
   ICAO Asia/Pacific ATN Transition Task Force Meeting, WP 24, Bali, 26-30, Apr., 2004
   Tasked by ICAO Asia/Pacific Planning Group supported by JCAB, MILT, Japanese Government

Professor

Ikuo NAKATA

Refereed Publications

1. Mitsugu Suzuki, Nobuhisa Fujinami, Takeaki Fukuoka, Tan Watanabe and Ikuo Nakata, " Data size Inference for Multimedia SIMD Instructions ", IPSJ Tran. on Programming, vol. 45, no. SIG 5(PRO21), pp. 1-11, 2004, (in Japanese).

Abstract — Most of recent processors have been equipped with multimedia SIMD instruction set which is intended to accelerate speeds of media processing programs. Although programmers are using assembly languages or intrinsic routines on coding hot spots of the programs to exploit the SIMD instructions, compilers should generate SIMD codes automatically for portability and maintainability of the programs. "Integral promotion" rule in a high level language often becomes an obstacle for discovering code fragments which can be translated into appropriate SIMD instructions. If compilers obey the rule strictly, they cannot translate the fragments into the SIMD instructions as the programmers does in assembly languages, etc. In this paper, we present a code analysis method based on "data size inference". It increases translatability and parallelism in using the SIMD instructions, while it guarantees the same result as the integral promotion rule is strictly obeyed.

Professor

Kenji OHMORI

Books

Other Publications

1. Daisuke HORINOUE, Kenji OHMORI, " Internet Accounting System: The Development Using Model Driven Architecture", IEICE OIS report, Nov. 2004,pp 77-84. (in Japanese)

Abstract — Software development has to be changed from a handcraft way to an industrialized way. Different from hardware products, software development has the property of complex systems in the same way that physics and economics do. The SECI model for knowledge creative companies contributes to sophisticated ideas for the software development. A rational unified process gives an effective tool for realizing it. We will introduce a new method using a model driven architecture with a rational unified process and apply it to the application program for an Internet accounting system. The system automatically generates program codes and system configuration files from use-case, activity and class diagrams specified by a rational unified process working with the technologies of a model driven architecture. 92.9% of the whole codes have been generated automatically from the diagrams, which gives us very sufficient results.

Professor

Akira K. ONOMA

Model-based Testing and Maintenance

D. Deng, P. C.-Y. Sheu, T. Wang, and A. K. Onoma, Proceedings of IEEE 6th International Symposium on Multimedia Software Engineering, 13-15 December 2004, Miami, Florida, USA, pp. 278-285.

Abstract — This paper presents a Semantic Software Development Model (SSDM) for object-oriented software. It organizes all the information generated during the software development lifecycle including requirements, design, implementation, testing, and maintenance. Based on SSDM, software testing and maintenance can be carried out in a more systematic, effective, efficient and manner, and can be enhanced by a set of proactive rules defined.

Professor

Shietung PENG

Refereed Publications

1. Yamin Li, Shietung Peng, and Wanming Chu, "Fault-Tolerant Cycle Embedding in Hypercube with Mixed Link and Node Failures", *Proceedings of the IASTED International Conference on Parallel and Distributed Computing and Networks*, February, 2004, Innsbruck, Austria. pp. 561-566.

   Abstract — In this paper, we show that given a binary n-cube with $f_e \leq n-2$ and $f_e + f_v \leq 2n-4$, where f_e and f_v are the numbers of faulty links and faulty nodes, respectively, there exists a fault-free cycle of length at least $2^n - 2f_v$. This result is better than any previous results in the literature.

2. Yamin Li, Shietung Peng, and Wanming Chu, "Efficient Collective Communications in Dual-cube", The Journal of Supercomputing, Volume 4, issue 1, 2004, pp. 71-90.

   Abstract — The hypercube, or n-cube, has been widely used as the interconnection network in parallel computers. However, the major drawback of the hypercube is the increase in the number of communication links for each node with the increase in the total number of nodes in the system. This paper introduces a new interconnection network, namely dual-cube, for large-scale parallel computers and describes the algorithms for efficient collective communications in dual-cube. The dual-cube network mitigates the problem of increasing number of links in the large-scale hypercube network while retains hypercube's topological properties. Design of efficient routing algorithms for collective communications is the key issue for any interconnection network. In this paper, we show that the collective communications can be done in dual-cube with almost the same communication times as in hypercube.

3. Yamin Li, Shietung Peng, and Wanming Chu, "Adaptive-Subcube Fault Tolerant Routing in Dual-Cube with Very Large Number of Faulty Nodes", *Proceedings of the ISCA 17th International Conference on Parallel and Distributed Computing Systems*, San Francisco, California USA, September, 2004, pp. 222-228.

   Abstract — The dual-cube is a newly proposed interconnection network for linking a large amount of nodes with low node degree. It uses low-dimensional hypercubes as building blocks and keeps the main desired properties of the hypercubes. In this paper, we give an efficient algorithm for fault tolerant routing in dual-cube networks with a large number of faulty nodes. Our algorithm uses the adaptive-subcube technique to select a suitable dimension to route a node. This technique not only increases the routing

speed but also shortens the path and improves the successful routing rate. The experimental results show that, with high percentages of node failures, the algorithm can build routing paths with a very high probability. Our simulation results show that when a dual-cube with 32,768 nodes contains up to 20 percent faulty nodes, the success rate of constructing a fault-free path between any two nonfaulty nodes is 99.5 percent with a 4-subcube.

4. Yamin Li, Shietung Peng, and Wanming Chu, "An Efficient Algorithm for Fault Tolerant Routing Based on Adaptive Binomial-Tree Technique in Hypercubes", *Proceedings of the Fifth International Conference on Parallel and Distributed Computing, Applications and Technologies*, December, 2004 Singapore. pp. 196-201.

Abstract — We propose an efficient fault-tolerant routing algorithm for hypercube networks with a very large number of faulty nodes. The algorithm is distributed and local-information-based in the sense that each node in the network knows only its neighbors' status and no global information of the network is required by the algorithm. For any two given nonfaulty nodes in a hypercube network that may contain a large fraction of faulty nodes, the algorithm can find a fault-free path of nearly optimal length with very high probability. The algorithm uses the adaptive binomial-tree to select a suitable dimension to route a node. We perform empirical analysis of our algorithm through simulations under a uniform node failure distribution and a clustered node failure distribution. The experimental results show that the algorithm successfully finds a fault-free path of nearly optimal length with the probability larger than 90 percent in a hypercube network that may contain up to 50 percent faulty nodes.

5. Yamin Li, Shietung Peng, and Wanming Chu, "Binomial-Tree Fault Tolerant Routing in Dual-Cubes with Large Number of Faulty Nodes", *Proceedings of the International Symposium on Computational and Information Sciences.* Shanghai, China, December, 2004. pp. 51-56.

Abstract — A dual-cube DC(m) has m+1 links per node where m is the degree of a cluster (m-cube), and one extra link is used for connection between clusters. The dual-cube mitigates the problem of increasing number of links in the large-scale hypercube network while keeps most of the topological properties of the hypercube network. In this paper, we propose efficient algorithms for finding a nonfaulty routing path between any two nonfaulty nodes in the dual-cube with a large number of faulty nodes. A node $v \in$ DC(m) is called k-safe if v has at least k nonfaulty neighbors. The DC(m) is called k-safe if every node in DC(m) is k-safe. The first algorithm presented in this paper is an off-line algorithm that uses global information of faulty status. It finds a nonfaulty path of length at most $d(s,t)+O(k^2)$ in $O(|F|+m)$ time for any two nonfaulty nodes s and t in the k-safe DC(m) with number of faulty nodes $|F| < 2^k(m+1-k)$, where $0 \le k \le m/2$. The second algorithm is an online algorithm that uses local information only. It can find a fault-free path with high probability in an arbitrarily faulty dual-cube with unbounded number of faulty nodes.

Professor

Yuji SATO

Refereed Publications

1. Yuji Sato, "Achieving Shorter Search Times in Voice Quality Conversion Using Interactive Evolution", Proc. of the 5th Inter. Conf. on Simulated Evolution And Learning (SEAL-2004), October 2004.

   Abstract — In this paper we propose improved techniques for the generation of initial entities and genetic manipulation in order to reducing the workload associated with human evaluation in interactive evolution of prosodic control and achieve shorter search times. We perform experiments both on natural speech and on synthetic speech generated from text data, and we assess the results in terms of the number of evaluations and the number of generations of genetic manipulation needed to reach a quasi-optimal solution in practice. As a result, we confirm that the proposed improvements make it possible to perform voice quality conversion more efficiently than when using the technique proposed earlier.

2. Ryuji Goto and Yuji Sato, "The Analysis for the Characteristics of the Time Series Signals with Genetic Algorithms", Proc. of the Second Inter. Conf. on Computing, Communications and Control Technologies (CCCT-2004), Vol. 1, pp. 267-272, August 2004.

   Abstract — Issues such as multi objective optimization, time series prediction, the analysis of noisy observation data, and the solution of implicit functions are all crucial in the consideration of real world problems. In this paper, we report the analysis for the characteristics of the time series periodic signal with GA. Subjects of this research are the same kinds of above issues. The time series signals like electronic sounds are periodic in many cases. Though the sounds like voice, mechanical vibration and internal organs are not periodic during long periods, but periodic during some periods in many cases. To analyze the characteristics of the time series periodic signal is to analyze its frequency components, the amplitudes and the phase of each frequency. As the result of simulations, we could prove that GA has the ability to analysis the characteristics (frequency components, amplitudes and phases of each frequency) of the time series periodic signal concurrently.

3. Yuji Sato, "Achieving Shorter Search Times in Voice Conversion Using Interactive Evolution", LNCS 3103 (GECCO-2004), Kalyanmoy D., et. al. (Eds.), Springer-Verlag, pp. 1328-1329, June 2004.

   Abstract — We have already proposed using evolutionary computation to adjust the voice quality conversion parameters, and we have reported that this approach produces

results that are not only closer to the desired target than the results of parameter adjustment based on designer experience or trial and error, but which also have relatively little sound quality degradation. In this paper we propose improved techniques for the generation of initial entities and genetic manipulation in order to reducing the workload associated with human evaluation in interactive evolution. We perform voice quality conversion experiments both on natural speech recorded with a microphone and on synthetic speech generated from text data. As a result, we confirm that the proposed improvements make it possible to perform voice quality conversion more efficiently than when using the technique proposed earlier.

4. Ryuji Goto and Yuji Sato, "The Analysis for the Path of an Object in Earth Orbit with Genetic Algorithms", Proc. of the Ninth Int. Symp. on Artificial Life and Robotics (AROB-2004), pp. 253-258, January 2004.

Abstract — Issues such as multi objective optimization, time series prediction, the analysis of noisy observation data, and the solution of implicit functions are all crucial in the consideration of real world problems, and research into the applicability of evolutionary computer techniques to these problems has already begun. However, these are only a few examples of studies where evolutionary computer techniques have been applied to problems that involve all of these issues at the same time. In this paper, we verify the applicability of genetic algorithms to the analysis for the path of an object in earth orbit that involve all of these issues at the same time.

Professor

Hiroshi HANAIZUMI

Refereed Publications

1. Eisaku Ohbuchi, Hiroshi Hanaizumi and Lim Ah Hock, "Barcode Readers using the Camera Device in Mobile Phones ," Proc. Int Sympo Cyberworlds 2004, pp.260-265, Nov. 2004

2. Kazuto Tokunaga and Hiroshi Hanaizumi, "Extraction of the Thoracic Aorta Territory and Aneurysm from CT Images," Proc. SICE Annual Conf. 2004, pp.2188-2192, Aug. 2004

3. Mari YOSHIDA and Hiroshi HANAIZUMI, "A Method for Extract Flow Lines in Coral Reef Field using Aerial Photographs," Proc. SICE Annual Conf. 2004, pp.1932-1935
   Aug. 2004

4. Noriyuki CHIBA and Hiroshi HANAIZUMI, "Three-Dimensional Face Recognition System - System Configuration -," Proc. SICE Annual Conf. 2004, pp.1191-1195, Aug. 2004

5. Noriyuki CHIBA and Hiroshi HANAIZUMI, "Tree-Dimensional Face Recognition System - Robust Face Recognition System Against Head Pose and Scale -,"
   Meeting on Image Recognition and Understanding 2004(MIRU2004), Vol.I, pp.577-582, June 2004

Oral Presentation

1. Hiroshi HANAIZIMI, Kazuto TOKUNAGA and Shin ISHIMARU, "The automated method for detection of the chest aortic aneurysm using helical CT data, " IEICE Technical Report, vol.103, No.599, pp.23-28, Jan. 2004

2. Hiroshi HANAIZUMI, "A Registration Method for Lung Vessels Extracted from Multi-temporal Helical CT Data, " IEICE Technical Report, vol.103, No.598, pp.89-94, Jan. 2004

3. Daisuke TERASAKI and Hiroshi HANAIZUMI, "Extraction of Three Dimensional Structures of Tubular Objects by Minimization of Sectional Area," IEICE Technical Report, vol.103, No.597, pp.77-82, Jan. 2004

Professor

Munetake ICHIMURA

Books

1. Munetake Ichimura and Satoru Kano, "Introduction to Physics 1. Mechanics", Tokyo Kagaku Doujin, ISBN 4-8079-0578-3, 2004. (in Japanese)

   Abstract — Textbook for introductory course of physics.
   Volume 1 is devoted to classical mechanics

Refereed Publications

1. T, Wakasa, H. Sakai, M. Ichimura, *et al.* , "Polarization transfer and spin response functions of ^{2}He(p, n) reaction at 345 MeV", Phys. Rev C 69 (2004) 044602-1--7.

   Abstract — Differential cross sections and a complete set of polarization observables have been measured for quasielastic 2He(p,n) reactions at a bombarding energy of 345 MeV. The data are compared with plane-wave impulse approximation calculation employing an optimal factorization approximation. The agreement between the experimental and theoretical results validates these approximations in the present momentum- and energy-transfer region. The experimental spin-longitudinal and spin-transverse response functions are deduced. The obtained spin-transverse response function is consistent with that obtained from the quasielastic electron scatterings.

2. T, Wakasa, H. Sakai, M. Ichimura, *et al.* , "Pionic enhancement in quasielastic (p,n) reactions at 345MeV" Phys. Rev C 69 (2004) 054609-1--9.

   Abstract — Differential cross sections and a complete set of polarization observables have been measured for quasielastic (p,n) reactions ^{12}C and ^{40}Ca at a bombarding energy of 345 MeV. The spin-longitudinal and spin-transverse polarized cross section, IDq and IDp, are deduced. Theoretically expected enhancement in the spin-longitudinal mode is observed. The observed IDq is consistent with the pionic enhanced IDq evaluated in distorted wave impulse approximation calculation employing random phase approximation response function. This implies the existence of a precursor to pion condensation in nuclei.

Professor

Tsuneo IKEDO

Other Publications

1. T. Ikedo US Patent PCT/JP2004/002792 "Light Reflection Shader"

2. T. Ikedo Japan Patent Pat. No.3577654 "Bump-map Shading Circuit"

Professor

Jianhua MA

Refereed Publications

1. Tomomi Kawashima and Jianhua Ma, "TOMSCOP – A Synchronous P2P Collaboration Platform over JXTA", IEEE CS Press Proc. of the International Workshop on Multimedia Network Systems and Applications (MNSA'2004), in conjunction with the 24th IEEE International Conference on Distributed Computing Systems (ICDCS-2004), Tokyo, Japan, March, 2004.

   Abstract — This paper focuses on design and implementation of a synchronous P2P (Peer-to-Peer) collaboration platform called TOMSCOP (Technology Of Multi-user Synchronous COllaboration Platform). Based on the elementary peer group services offered by the JXTA general framework, TOMSCOP provides the extra four types of services: synchronous message transportation, peer room administration, peer communication support and application space management. By using the four services, different kinds of shared applications for various specific purposes can be relatively easily developed and associated collaborative cyber spaces or communities can be quickly built across the JXTA virtual network overlaid on top of the existing physical networks.

2. Runhe Huang, T Yamazaki and Jianhua Ma, "A Mobile Negotiation Agent Embedded Hybrid Online Purchasing System", IEEE CS Press Proc. of the International Workshop on Multimedia Network Systems and Applications (MNSA'2004), in conjunction with the 24th IEEE International Conference on Distributed Computing Systems (ICDCS-2004), Tokyo, Japan, March, 2004.

   Abstract — This paper presents a mobile negotiation agent under the proposed hybrid architecture and shows how a buyer negotiation agent conducts online purchasing activities automatically. This paper gives the detailed about our design ideas, the system architecture and implementations. Comparisons with other related work are reported in the paper.

3. Ryosuke Komatsu, Jianhua Ma and Qun Jin, "A Multi-Agent System for Online Course Content Management", IEEE CS Press Proc. of the 18th IEEE International Conference on Advanced Information Network and Applications (AINA'04), Fukuoka, March 2004.

   Abstract — This paper presents a multi-agent system to assist a teacher managing his/her course contents placed on web servers. In this system there is a set of agents and every agent may work independently from or collaboratively with others. Once generated, an agent can reside in a teacher's daily working computer (called administration host) or

a proxy host, and can move between the two hosts. Each agent is devoted to one piece of job and all of them, as a whole, coordinately conduct a sequence of management work during the entire process of teaching a course. A teacher may administrate agents via a specific system shell on his/her administration host, or a usual web browser on another computer/PDA/mobile phone. The system has been carefully modularized, and thus a new type of agent, if necessary, can be relatively easily developed and quickly incorporated into the system to further enhance or extend its management capability.

4. Katsuhiro Takata and Jianhua Ma, "GRAM – A P2P System of Group Revision Assistance Management", IEEE CS Press Proc. of the 18th IEEE International Conference on Advanced Information Network and Applications (AINA'04), Fukuoka, March 2004.

Abstract — This paper focuses on general design and prototype implementation of a peer-to-peer (P2P) and a proactive mechanism based version management system called GRAM (Group Revision Assistance Management). It provides four special features in comparison with other version management systems: higher system reliability and robustness, effective revision collision prevention using proactive agents, context-aware environment for team software revision, a unified XML format for configuration and history files as well as system and agent exchange messages. GRAM is implemented using the JXTA technology that consists of the virtual JXTA network and basic peer group services. The system GUI and basic functions in the current prototype are also presented to show its basic usages.

5. Jianhua Ma, Leonard Barolli, Makoto Shizuka and Runhe Huang, "A Pure P2P Synchronous Collaborative System", in the International Journal of Applied System Studies (JASS), Cambridge International Science Publishing, Cambridge, England, No.2, Vol.5, July 2004, pp. 133-145.

Abstract — This paper presents design and implementation of a collaborative system, called DSC, based on a pure P2P architecture, i.e., a decentralized topology, without using any server at all. It relies on group agents located on peers' computers to coordinate group as well as peer management, and provides a message handler to deal with the correct message passing directly among group peers. DSC is implemented using JXTA technology that includes virtual JXTA networks, a set of standard protocols and basic services to let peers finding each other, forming groups, and exchanging messages across firewalls and NATs. Our system currently offers four shared objects, a web html file browser, a plain text file viewer, an audio player and a drawing pad as well as a text chat tool.

6. Jianhua Ma, Ryosuke Komatsu and Runhe Huang, "A Web-based Teacher Assisting Agent System", Springer-Verlag Lecture Notes in Computer Science, Advances in Web-Based Learning – ICWL'2004, Volume 3143, ISBN 3-540-22542-0, 2004, pp. 317-324.

Abstract — In the conventional teaching, teaching assistances (TAs) play importance roles in supporting a teacher's teaching activities. This paper presents a Web-based teacher assisting agent system in which a set of automated programs, so called agents in this context, is developed. It is described that how the agents are generated, where they reside, and how they work independently or collaborate with each other to assist a teacher. It is emphasized that a later developed working agent can be easily incorporated into the system under the developed system framework. It is addressed that both agent persistency and mobility in the system can be achieved by the proposed mechanisms.

7. Makoto Shizuka, Jianhua Ma, Jeneung Lee, Yoichiro Miyoshi and K. Takata, "A P2P Ubiquitous System for Testing Network Programs", Springer-Verlag Lecture Notes in Computer Science, Embedded And Ubiquitous Computing – EUC'2004, Vol. 3207, August 2004, pp. 1004-1013.

Abstract — This paper presents design and implementation of a peer-to-peer (P2P) ubiquitous system for assisting a programmer to efficiently test network programs in their development process by using multiple computers simultaneously. This system is implemented using the TOMSCOP a synchronous P2P collaboration platform built atop the JXTA technology. This system has the following three main features. Firstly, it enables the program source files being shared among peers. Secondly, a user is able to simultaneously compile, execute and stop network programs of all peers in a same group by simple operations on the system GUI. Lastly, due to using Java and JXTA technology, the system can run on any platform.

8. Katsuhiro Takata and Jianhua Ma, "Proactive Control of Group Revision Assistance Management Using P2P Technology", International Symposium on Communications and Information Technologies (ISCIT04), Sapporo, Japan, October, 2004.

Abstract — One major problem in the group revision systems is the revision collision when two or more users have revised identical lines in a source code and those lines with different revisions hit each other in their merging process. The better way to solve the problem is based on a proactive mechanism, i.e., taking some actions to prevent and thus greatly reduce collisions. Therefore, GRAM has adopted the following two proactive approaches: (1) using monitor-alert agents [15] to monitor users' source file editing processes, exchange messages with each other via direct P2P communications, and alert the users some possible collisions, and (2) is providing a context-aware team development environment to let a user be aware of what others are doing and how source codes are revised.

9. Jianhua Ma, Bernady O. Apduhan and Leonard Barolli, "Ubikids – A Ubiquitous Smart Hyperspace for Kids Care", Proc. of the IPSJ Symposium Series, Vol. 2004, No. 15, ISSN 1344-0640, Ishikawa, Japan, December, 2004.

Abstract — Following ubiquitous computers (UC) and ubiquitous networks (UN), is a road towards ubiquitous intelligence (UI) or a smart world (SW). This is a collection of smart hyperspaces consisting of interconnected smart spaces or environments including smart objects embedded or attached with small or tiny networked computers/processors. Ubikids is an on-going project aimed to build a ubiquitous smart hyperspace to assist parents, provide them more convenience, be more prompt, reliable, precise, and with the option to remotely take care of their kids. This article describes our visions, motivations, approaches, design issues, problems and so on regarding the project Ubikids.

10. N. Nakamura, S. Takahama, Leonard Barolli, Jianhua Ma and K. Sugita, "A Multiplatform P2P System: Its Implementation and Applications", Proc. of the IPSJ Symposium Series, Vol. 2004, No. 15, ISSN 1344-0640, Ishikawa, Japan, December, 2004.

Abstract — Peer-to-Peer (P2P) computing offers many attractive features, such as collaboration, self-organization, load balancing, availability, fault tolerance and anonymity. However, it also faces many serious challenges. In our previous work, we implemented a synchronous P2P collaboration platform called TOMSCOP, but it was mainly based on Windows operating system environments. In this paper, we extend our previous work and present the implementation of a Multi-Platform P2P System (MPPS). It operates very smoothly in Unix Solaris 9, Linux Suse 9.1, Mac OSX, and other OSs. We shall to further evaluate the implementation with dealing with security problems.

11. Runhe Huang, Takeshi Yamazaki, and Jianhua Ma, "A Mobile Intelligent Negotiation Agent Embedded and Hybrid Architecture Based Online Purchasing System", in the International Journal of Wireless and Mobile Computing, Inderscience Publishers, ISSN 1741-1084, No. 4, December, 2004.

Abstract — This paper proposes a *m*obile intelligent *ne*gotiation *age*nt embedded and *h*ybrid architecture based *o*nline *p*urchasing *s*ystem (*MineAgeHops* in short) with three emphases: agent mobility, intelligent negotiation, and hybrid architecture. Like in the physical world, a buyer agent can travel over the Internet to a remote e-shop for obtaining information about a product and negotiating on the product with a seller. Human negotiation is a complex process. The evolutionary negotiation model makes an effort to reflect different negotiation levels of human with increasing knowledge and experience as time goes. A hybrid of centralized and decentralized architecture can overcome the network bottleneck problem as well as improve purchasing efficiency by enabling agent mobility and flexibility.

12. Katsuhiro Takata and Jianhua Ma, "A Decentralized P2P Revision Management System Using a Proactive Mechanism", in the International Journal of High Performance Computing and Networking, Inderscience Publishers, ISSN 1740-0562, No. 4, December, 2004.

Abstract — This paper presents a prototype and evaluations of the GRAM, a peer-to-peer (P2P) and a revision management system based on a proactive mechanism. GRAM performs revision collision prevention management and software source code synchronization in a potential overlay network of peers connected via the Internet or a LAN/WAN. Each peer of the GRAM system has a unique identifier provided by the JXTA framework, and holds two spaces: a shared space synchronized other peers' ones, and a workspace for a user's ordinary editing. Experimental results obtained with a prototype implementation on an enumerated network confirm GRAM's efficiency.

Professor

Toshihisa NISHIJIMA

Other Publications

1. Toshihisa Nishijima, "Structure of the Hamming Weight Distribution of a Reed-Solomon Code", Proceedings of the 2004 Shannon Theory Workshop, pp. 41-44, July 15-17, 2004 Shirahama, Wakayama, Japan.

2. Toshihisa Nishijima, "Structure of the Hamming Weight Distribution of a Reed-Solomon Code Derived from an Experiment", Proceedings of the 2004 Coding and Dynamical System Workshop, pp. 59-63, September 5-7, 2004 Sujiyu, Ohita, Japan.

3. Toshihisa Nishijima, "An Approach to the Complete Weight Distribution of a Reed-Solomon Code", Technical Report of IEICE, IT2004-40, pp. 13-18, September 17-18, 2004 Osaka, Japan.

4. Toshihisa Nishijima, "Structure of the Hamming Weight Distribution of a Reed-Solomon Code", Proceedings of the Workshop on Concepts in Information Theory, pp. 61-64, October 6-8, 2004 Viareggio, Italy.

Professor

Alexander PASKO

Books

1. Shape Modeling and Applications, Proceedings of the International Conference, F. Giannini, A. Pasko (Eds.), ISBN 0-7695-1909-1, IEEE Computer Society, 2004.

   Abstract — Proceedings of the International Conference SMI'04 held on 7-9 June 2004 in Genova, Italy. 79 papers were submitted out of which 29 papers were selected for presentation and inclusion in this volume. Theaccepted contributions mainly focus on modelling implicit surfaces, surface meshes, point sets and subdivision surfaces, shape retrieval, feature-based modeling and deformations, interactive modelling.

2. Spring Conference on Computer Graphics, Proceedings, Ed. A. Pasko, ISBN 1-58113-914-4, ACM Press, 2004.

   Abstract — Proceedings of the International Conference SCCG'04 held on April 22 - 24, 2004 in Budmerice, Slovak Republic. 20 of 38 submitted full papers have been accepted. The topics include: visualization, illumination, virtual environments, computer animation, reconstruction and modeling, implicit surfaces.

Refereed Publications

1. B. Schmitt, A. Pasko, C. Schlick, Constructive sculpting of heterogeneous volumetric objects using trivariate B-splines, The Visual Computer, vol. 20, Nos. 2-3, 2004, pp. 130 - 148.

   Abstract — This paper deals with modeling heterogeneous volumetric objects as point sets with attributes using trivariate B-splines. The function representation (FRep) is used as the basic model for both object geometry and attributes represented independently using real-valued scalar functions of point coordinates. We propose a volume sculpting scheme with multiresolution capability based on trivariate B-spline functions. An interactive volume modeler based on trivariate B-splines and other simple primitives is described, with a real time re-polygonization of the surface during modeling.

2. G. Pasko, A. Pasko, T. Kunii, Space-time blending, Computer Animation and Virtual Worlds, vol. 15, No. 2, 2004, pp. 109-121.

   Abstract — Shape transformation between objects of different topology and positions in space is an open modeling problem. We propose a new approach to solving this problem for two given 2D or 3D shapes. The key steps of the proposed algorithm are: increase

dimension by converting two input kD shapes into half-cylinders in (k+1)D space-time, applying bounded blending with added material to the half-cylinders, and making cross-sections for getting intermediate shapes under the transformation. The additional dimension is considered as time coordinate for making animation. We use the bounded blending set operations in space-time defined using R-functions and displacement functions with the localized area of influence.

3. C. Vilbrandt, G. Pasko, A. Pasko, P.-A. Fayolle, T. Vilbrandt, J. R. Goodwin, J. M. Goodwin, T. L. Kunii, Cultural heritage preservation using constructive shape modeling, Computer Graphics Forum, vol. 23, No.1, 2004, pp. 25-41.

Abstract — Issues of digital preservation of shapes and internal structures of historical cultural objects are discussed. We propose a new digital preservation paradigm based on both constructive modeling reflecting the logical structure of the objects and open standards and procedures. Constructive Solid Geometry (CSG) and Function Representation (FRep) are examined and practically applied as mathematical representations producing compressed yet precise data structures. Examples of CSG reconstruction of historical temples and FRep modeling of traditional lacquer ware are given. We examine the application of fitting of a parameterized FRep model to a cloud of data points as a step towards automation of the modeling process. Virtual venues for public access to cultural heritage objects including real time interactive simulation of cultural heritage sites over the Web are discussed and illustrated.

4. G. Pasko, A. Pasko, Trimming implicit surfaces, The Visual Computer, vol. 20, No. 7, 2004, pp. 437-447.

Abstract — Algorithms of trimming implicit surfaces yielding surface sheets and stripes are presented. These two-dimensional manifolds with boundaries result from set-theoretic operations on an implicit surface and a solid or another implicit surface. The algorithms generate adaptive polygonal approximation of the trimmed surfaces by extending our original implicit surface polygonization algorithm. The presented applications include modeling several spiral shaped surface sheets and stripes (after M. Escher's art works) and extraction of ridges on implicit surfaces. Another promising application of the presented algorithms is modeling heterogeneous objects as implicit complexes.

5. P.-A. Fayolle, A. Pasko, N. Mirenkov, Fitting of parameterized FRep shape models, The Journal of Three Dimensional Images, vol. 18, No. 1, 2004, pp. 40-46.

Abstract — We introduce the use of parameterized Function Representation (FRep) for reverse engineering of constructive solids in CAD applications. Recovering the best parameters of a FRep model from the given scanned surface points turns out to be a difficult problem of nonlinear optimization. We recall the traditional methods for solving such problems: direct methods like Levenberg Marquardt or Full Newton and sampling

methods like simulated annealing. In order to overcome problems of each method, we combine them in a two-step process. We apply and compare all these different methods to the recovery of a mechanical part.

6. A. Pasko, V. Adzhiev, Function-based shape modeling: mathematical framework and specialized language, Automated Deduction in Geometry, Lecture Notes in Artificial Intelligence 2930, Ed. F. Winkler, Springer-Verlag, 2004, pp. 132-160.

   Abstract — In this survey, we describe the mathematical framework of the unifying function representation (FRep), give examples of some non-traditional primitives and operations, and describe the modelling system design including the internal representation and the specialized high-level modelling language.

7. T. Nieda, A. Pasko, T. L. Kunii, Detection of critical points for shape metamorphosis animation, 10th International Multimedia Modelling Conference MMM 2004, Ed. Y.-P. Phoebe Chen, IEEE Computer Society, 2004, pp. 93-100.

   Abstract — We apply topological analysis to functionally based shape metamorphosis. The time-dependent shape is defined using homotopy. We have to find a way to automatically detect the critical points on the time axis while the shape undergoes topological changes. These critical points can be later used for generation of non-linear time steps distribution along the time axis, for example, for providing ease-in/ease-out effects in animation. We present a new method for analysis of shape metamorphosis based on the Morse theory, oriented to analysis of a height function.

8. G. Pasko, A. Pasko, M. Ikeda, T. L. Kunii, Advanced metamorphosis based on bounded space-time blending, 10th International Multimedia Modelling Conference MMM, Ed. Y.-P. Phoebe Chen, IEEE Computer Society, 2004, pp. 211-217.

   Abstract — We further develop a new approach to shape metamorphosis using bounded blending operations in space-time. This approach is extended here in two directions. First, the problem of "jump" in animation or the rapid transition between shapes in the given interval is solved using "smoothed" versions of half-cylinders which undergo bounded blending. Second, the approach is extended to 3D initial and final shapes with the bounded blending union operation applied to the corresponding "smoothed" 4D space-time half-cylinders.

9. P. Reuter, B. Schmitt, C. Schlick, A. Pasko, Interactive solid texturing using point-based multiresolution representations, Journal of WSCG, Proceedings of WSCG 2004, vol. 12, No. 3, pp. 363-370.

Abstract — This paper presents an interactive environment for texturing surfaces of arbitrary 3D objects. By uniquely using solid textures and applying them to the surface, we do not require an explicit parameterisation in texture space. Various solid textures can be combined by building a constructive texturing tree of space partitions to define the photometric attributes at each location of the object. We use a multiresolution point-based representation ensuring that texture evaluation and rendering maintains a given frame rate. Our tool is realized as a plugin for the Pointshop3D system.

10. P.-A. Fayolle, A. Pasko, E. Kartasheva, N. Mirenkov. Shape recovery of functionally represented constructive models, Shape Modeling International, IEEE Computer Society, 2004, pp. 375-378.

Abstract — We propose a method which helps to fit existing parameterized function representation (FRep) models to a given dataset of 3D surface points. Best fitted parameters of the model are obtained by using a hybrid algorithm combining simulated annealing and Levenberg-Marquardt methods. The efficiency of the approach is shown for recovery of two test items. We show through the CAD model processing an application of the proposed approach to the shape recovery followed by finite element mesh generation and adaptation.

11. T. Someya, V. Adzhiev, A. Pasko, P. Comninos, Direct rapid prototyping for augmented sculpting, MAAP 2004 Proceedings, Multimedia Art Asia Pacific International Conference, Singapore, ISBN 981-05-2187-1, 2004, 9 pp. (CD publication).

Abstract — This paper presents an augmented sculpting approach starting from real sculptures, going through virtual models, and finally producing new physical artefacts. New virtual models are generated by automatic or interactive group metamorphosis. The selected model is physically produced using direct rapid prototyping based on slices of the object model in contrast to traditional surface mesh data techniques.

12. B. Schmitt, A. Pasko, G. Pasko, T. Kunii, Rendering trimmed implicit surfaces and curves, AFRIGRAPH 2004 Proceedings, publication of ACM SIGGRAPH, 2004, pp. 7-13.

Abstract — Models of implicit surfaces and curves trimmed by a solid are discussed in the context of dimensionally heterogeneous object modeling. Both a carrier surface and a trimming solid are modeled using the function representation. Algorithms for polygonization of trimmed surfaces and curves, as well as ray-tracing of trimmed surfaces are described. Illustrative and CAD related examples are given.

13. T. Nieda, A. Pasko, T. L. Kunii, Detection and classification of critical points for linear metamorphosis, International Conference on Cyberworlds (18-20 November 2004, Tokyo, Japan), IEEE Computer Society, 2004, pp. 384-391.

Abstract — We apply topological analysis to functionally based shape metamorphosis. For the critical points of topological changes, we present a method of detection based on the Morse theory and classification using the Hessian matrix . We classify the detected critical points into maximum point, minimum point, and saddle point types. Using the type of the critical points and the sign of the function time derivative at the critical points, we can define the topological information for the shape metamorphosis.

Other Publications

1. G. Pasko, T. Nieda, A. Pasko, T. L. Kunii, Space-time modeling and analysis, Proceedings of the 20th Spring Conference on Computer Graphics, ACM Press, 2004, pp. 13 - 20 (invited paper)

2. B. Schmitt, P.-A. Fayolle, A. Pasko, Modélisation d'objets hétérogènes pour l'informatique graphique et industrielle, JSF 2004 Symposium (Journees Scientifiques Francophones), 4-5 November 2004, Tokyo, Japan, 6 p. (in French, electronic publication).

3. P.-A. Fayolle, B. Schmitt, A. Pasko, Approximation de la distance Euclidéenne et applications en modélisation et synthèse d'images, JSF 2004 Symposium (Journees Scientifiques Francophones), 4-5 November 2004, Tokyo, Japan, 6 p. (in French, electronic publication)..

4. P.-A. Fayolle, B. Schmitt., Y. Goto , A. Pasko, Web-based constructive shape modeling using real distance functions, Technical Report HCIS-2004-02, Hosei University, Tokyo, Japan, October 1, 2004, 18 p.

5. P.-A. Fayolle, A. Pasko, B. Schmitt, N. Mirenkov, Heterogeneous object modeling using signed approximate real distance functions, Technical Report 2004-1-002, University of Aizu, Aizu-Wakamatsu, Japan, 2004, 38 p.

Professor

Yukiko SASAKI ALAM

Refereed Publications

1. Yukiko Sasaki Alam, "Decision Trees for Sense Disambiguations: Case of Over", Proceedings of the Workshop on Computational Lexical Semantics Held in Cooperation with HLT-NAACL 2004, pp. 52-59.

Abstract — This paper proposes two decision trees for determining the meanings of the prepositional uses of over by using the contextual information. It first examines the meanings of the prepositional uses of over and then aims at identifying the contexts for interpreting the meanings. Some contexts are complementary features, and that makes the decision trees simple. The trees have been tested on a corpus, and the results are encouraging.

Professor

Vladimir SAVCHENKO

Refereed Publications

1. N. Kozhekin, Y. Taniguchi, I. Hagiwara, and V. Savchenko, "Using CSRBF for Surface Retouching", IPSJ (Information Processing Society of Japan) Journal, 24(5), 2004, 1202-1211 (in Japanese)

   Abstract — We propose a new technique for retouching of damaged surface areas and employ the method of compactly supported radial basis functions for a problem of fulfillment of such areas. By using our method, we can retouch disconnected large areas.

2. V. Savchenko, M. Savchenko, O. Egorova, and I. Hagiwara, "Surface Simplification Based on a Statistical Approach", WSEAS TRANSACTIONS on CIRCUITS and SYSTEMS, Issue 1, Volume 3, ISSN 1109-2734, Jan. 2004, 159-164

   Abstract — This paper presents work in progress and continues a project devoted to developing shape modeling system for surface generation and enhancement. A local mesh enhancement based on statistical characteristics of an initial triangle mesh is proposed for mesh simplification. Experimental results are included to demonstrate the functionality of our simplification algorithm.

3. A. Illarionov, E. Sedych, and V. Savchenko, "Simulation of the 3D Space Equilibbrium of Gravitating, Rotating, and Magnetized Matter", WSEAS TRANSACTIONS on CIRCUITS and SYSTEMS, Issue 1,Volume 3, ISSN 1109-2734, Jan. 2004, 123-126

   Abstract — This paper presents work in progress in the field of the simulation of the complex physical systems and discusses methods of visualization to obtain and analyze results in 3D space. We consider the rapidly spinning gravitating object with dipole-like magnetic field.

4. I. Semenova, V. Savchenko, I. Hagiwara, "Improvement of Triangular and Quadrileteral Surface Meshes", Proceedings 14th International Conference on Computer Graphics and Vision (Graphicon`2004), Sept. 2004, 79-87

   Abstract — In this paper, we present a new technique called Trapezium Drawing to improve surface mesh quality while maintaining the essential surface characteristics. In contrast to previous methods we do not tend to preserve new mesh vertices on the original discrete surface. Instead our approach allows keeping new mesh close to the surface

approximated by the initial mesh. All operations are performed directly on the surface. As a result our technique is robust and runs at interactive speeds. It can be applied to triangular and quadrilateral meshes iteratively. Various quantitative measures are presented to demonstrate the effectiveness of proposed technique.

5. I. Semenova, V. Savchenko, I. Hagiwara, "Two techniques to Improve Mesh Quality and Preserve Surface Characteristics", Proceedings 13th International Meshing Rountable, Sept., USA, 2004, 277-288

Abstract — We present two novel techniques to improve quality of surface meshes while preserving surface characteristics as much as possible. The first technique called Trapezium Drawing is iterative and can be easy implemented for all type of meshes. It does not use any information about surface geometry. On the contrary in the second technique to find new location each node of the mesh we use value of maximal curvature defined at this node. We show that the second curvature-based approach to mesh improvement gives the best results in the sense of keeping new mesh very close to the original surface and preserving surface characteristics such as normals and curvatures. But unlike the Trapezium Drawing algorithm it can be applied only for meshes representing smooth surfaces without sharp edges and corners. Different quantitative measures are presented to demonstrate the effectiveness of both proposed techniques.

6. M. Sato, V. Savchenko, R. Ohbuchi, "3D Freeform Design: Interactive Shape Deformations by the Use of CyberGlove", 2003 International Conference on CYBERWORLDS (CW 2004), Nov. 22-25, Tokyo, 2004, 147-154

Abstract — This paper presents an approach for interactive and intuitive deformation of 3D shapes. The approach combines a fast and efficient 3D free form deformation algorithm with a high degrees-of-freedom input device of hand joint angles, namely, the CyberGlove. The deformation algorithm employs Compactly Supported Radial Basis Functions (CSRBFs) to produce reasonable shape deformations quickly. However, positioning and moving CSRBFs properly to create a desired shape deformation is not a trivial task. In our approach, the 10 CSRBFs are virtually attached to the fingertips of the CyberGloves worn on both hands of the user. This allows the user an intuitive manipulation of 3D shapes in a manner somewhat similar to clay modeling. While the shape deformation algorithm is not physically-based, the shape deformation created by the algorithm is plausible and quite useful. In terms of speed, deformations involving all the 15k vertices of a 32k triangle mesh model can be produced at speed of about 30 frames-per-second.

7. V. Savchenko and M. Savchenko, "Approximation of 3D Point Sets Using 2D Local Sample-Based Interpolation", IASTED International Conference on Advances in Computer Science and Technology (ACST`04), Nov. 22-24, USA, 2004, 56-63

Abstract — We describe a novel algorithm for local approximation of scattered surface points, implementing a 2D finite element interpolation algorithm in combination with approximation of coordinates using quadrics for conversion of noisy data to sufficiently smooth data sets. The applied methods and time performance of the developed algorithm are discussed. Experimental results are included to demonstrate the functionality of our approximation technique.

Patent

I. Hagiwara, O. Egorova, M. Savchenko, and V. Savchenko, *Mesh Enhancement Based on Quasi-Statistical Modeling*, Japan patent No. 2004-272205 , Issued on 17 Sept. 2004

Other Publications

1. V. Savchenko, "STAR Report: Application of Radial Basis Functions for CAD and CG", Proceedings 14th International Conference on Computer Graphics and Vision (Graphicon`2004), Sept. 2004, 16-23

2. V. Savchenko, "Trends in CAD and CG", Proceedings Annual Conference of JSIAM (Japan Society Industrial and Applied Mathematics), Sept. 16-18, Tokyo, ISSN 1345-3378, 2004, 114-115 (Keynote talk)

3. N. Kozhekin, M. Senin, I. Hagiwara, and V. Savchenko, "Facial Animation System for Cell Phones and PDA", Proceedings Annual Conference of JSIAM (Japan Society Industrial and Applied Mathematics), Sept. 16-18, Tokyo, ISSN 1345-3378, 2004,118-119

4. Semenova, V. Savchenko, and I. Hagiwara, "A New Method for Improvement of Polygonal Surface Meshes", Proceedings Annual Conference of JSIAM (Japan Society Industrial and Applied Mathematics), Sept. 16-18, Tokyo, ISSN 1345-3378, 2004, 124-125

5. Egorova, M. Savchenko, I. Hagiwara, and V. Savchenko, "Quasi-statistical Modeling of Mesh Improvement Process", Proceedings Annual Conference of JSIAM (Japan Society Industrial and Applied Mathematics), Sept. 16-18, Tokyo, ISSN 1345-3378, 2004, 126-127

6. M. Savchenko, O. Egorova, I. Hagiwara, and V. Savchenko, "Mesh

Improvement Algorithms Based on Quasi-statistical Modeling", Proceedings Annual Conference of JSIAM (Japan Society Industrial and Applied Mathematics), Sept. 16-18, Tokyo, ISSN 1345-3378, 2004, 128-129

7. V. Savchenko, Problems and Solutions in CAD, Proceedings 17th Computational Mechanics Conference, Sendai, Japan, Nov. 2004, 207-208 (Keynote talk)

8. N. Kozhekin, M. Senin, V Savchenko, and I. Hagiwara, Simple CSRBF Animation System with Movement Interpolation and Collision Detections, Proceedings 17th Computational Mechanics Conference, Sendai, Japan, Nov. 2004, 213-214

Professor

Toru WAKAHARA

Refereed Publications

1. Toru Wakahara, "Adaptive Normalization of Handwritten Characters Using GAT Correlation and Mixture Models," in Proceedings of the 17th International Conference on Pattern Recognition, Vol.1, August 2004, pp. 393-396.

   Abstract — This paper proposes an adaptive or category-dependent normalization technique for handwritten characters featuring global affine transformation (GAT) correlation and mixture models. Key ideas are twofold. First, we estimate a probability density function (PDF) of black pixels for each category using mixture models of Gaussian distribution functions and the EM algorithm. Second, we determine optimal, global affine transformation that maximizes a normalized cross-correlation value between a GAT-superimposed input pattern and the above-mentioned PDF by the successive iteration method. Experiments using the handwritten numeral database IPTP CDROM1B show that the entropy of optimally GAT-superimposed test samples decreases substantially by more than 20%. We discuss the enhanced normalization ability and the computational complexity of the proposed method.

2. Chihiro Iga and Toru Wakahara, "Character Image Reconstruction from a Feature Space Using Shape Morphing and Genetic Algorithms," in Proceedings of the 9th International Workshop on Frontiers in Handwriting Recognition, October 2004, pp. 341-346.

   Abstract — This paper proposes a powerful method that realizes image reconstruction from a feature space in optical character recognition. Due to the invisibility of a high-dimensional feature space, it is difficult to fully understand advantages and disadvantages of the given feature space and search for more robust features. The proposed method consists of two parts. The first part is 2D shape morphing based on a mesh model via bilinear transformation. The second part is use of genetic algorithms for determining optimal morphing parameters. Given an arbitrary feature vector in a feature space the proposed method deforms each category's template to yield the maximal fitness value against the given feature vector and the deformed template thus obtained is considered as a reconstructed image from a feature space. In experiments we use the public handwritten numeral database IPTP CDROM1B and a gradient feature space. We first demonstrate a high matching ability of the proposed mesh model. Then, we show promising experimental results of image reconstruction from a feature space and discuss how to use this technique to improve recognition performance.

Other Publications

1. Toru Wakahara and Toshiaki Sugimura, "Scheme for Identifying Gray-Scale Image," U.S. Patent No. 6,658,149 B1. Feb. 2004.

Professor

Kenji YOSHIDA

Other Publications

1. Article about his invention product. "Printers Circle 8" P18

2. Patents:
   a) International Application No. PCT/JP03/16763 "INFORMATION INPUT AND OUTPUT METHOD BY USE OF DOT PATTERN Ⅱ" 2004/6/1
   b) International Application No. PCT/JP2004/7082 (there is not English title yet.) 2004/5/24
   c) International Application No. PCT/JP2004/015286 (there is not English title yet.) 2004/10/25
   d) "INFORMATION INPUT AND OUTPUT METHOD BY USE OF DOT PATTERN Ⅲ" 2004/12/24
   e) "INFORMATION INPUT AND OUTPUT METHOD BY USE OF DOT PATTERN Ⅳ" 2004/12/28

Professor

Shuichi YUKITA

Refereed Publications

1. Norihiro Fujii, Shuichi Yukita, Masahiko Koike, and Tosiyasu L. Kunii, "An E-Learning System Based on the Top-Down Method and the Cellular Models", International Journal of Distant Education Technologies, Vol. 2, No. 4, 2004, pp. 77-93.

Abstract — As the broadband connectivity to the Internet becomes common, Web based e-learning and distance learning have come to play the central roles for self-learning, where learners are given much flexibility in choosing place and time to study. However, the learners still have to spend a lot of time before reaching the learning goal. This discourages the learners from continuing their studies and diminishes their motivation. To overcome this problem and to let the learners keep focusing on their primary interests, we propose a top-down e-learning system called TDeLS. The TDeLS can offer learners the learning materials based on the top-down (i.e., goal-oriented) method, according to the learners' demands and purposes. Moreover, the TDeLS can distribute them to the learners through the Internet, and manage the database for learning materials. In order to share learning materials among learners through the Web, these learning materials are wrapped in XML with a specially designed vocabulary for TDeLS. We employed the cellular models that ensure the consistency among design modules and support a top-down design methodology. In this paper, we present the TDeLS for hardware logic design courses based on the cellular models. The primary goal is to design complex logic circuits in VerilogHDL, which is an industrial-standard hardware description language. This paper also presents the basic XML vocabulary designed to describe hardware modules efficiently, and a brief introduction to the structure and functions of the proposed system that implements the TDeLS.

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